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ANNCR: THE VOICE OF AMERICA PRESENTS...SCIENCE NOTEBOOK...

A SUMMARY OF EVENTS IN SCIENCE, MEDICINE AND TECHNOLOGY.
EACH WEEK AT THIS TIME, WE BRING YOU REPORTS ON DEVELOP-
MENTS THAT MAY AFFECT OUR DAILY LIVES. WITH THE FIRST
STORY, HERE IS YOUR SCIENCE EDITOR _____:

SAFEGUARDING STARLIGHT -- 3-3361 (DOSA)

EDITOR: EVERY CITY HAS ITS POLLUTION PROBLEMS -- AIR, WATER,
EVEN NOISE POLLUTION -- BUT THE CITY OF TUCSON, ARIZONA,
ALSO HAS A LIGHT POLLUTION PROBLEM, AS _____ REPORTS.

VOICE: TUCSON IS FREQUENTLY CALLED THE ASTRONOMICAL CAPITAL OF
THE WORLD. ITS IDEAL CLIMATIC CONDITIONS MAKE IT A
PERFECT PLACE FOR OBSERVING THE HEAVENS, AND THE CITY IN
THE ARIZONA DESERT IS SURROUNDED BY A NUMBER OF MAJOR
OBSERVATORIES LOCATED ON NEARBY MOUNTAINTOPS.

BUT THE SPRAWL OF THE FAST-GROWING CITY OF TUCSON
THREATENS THE OBSERVATORIES WITH LIGHT POLLUTION. THE
CITY LIGHTS GROW BRIGHTER AND MORE NUMEROUS EVERY
YEAR AND THEIR NIGHTTIME GLOW INTERFERES WITH THE
ASTRONOMICAL OBSERVATIONS, MASKING THE FAINT STARS
FROM VIEW.

ASTRONOMERS AT KITT PEAK NATIONAL OBSERVATORY, ONE OF THE
LARGEST IN THE WORLD, WERE GROWING INCREASINGLY
APPREHENSIVE ABOUT THE EFFECTS OF LIGHT POLLUTION.

VOICE:
(CONT)

SEVERAL YEARS AGO, THEY DECIDED TO MEASURE THE INTENSITY OF THE LIGHT GLOW IN THE NIGHT SKY.

THE ASTRONOMERS SET UP IDENTICAL CAMERAS TO PHOTOGRAPH THE SKY AT FOUR DIFFERENT LOCATIONS: IN THE CITIES OF TUCSON AND NEARBY PHOENIX, IN AN UNINHABITED AREA, AND AT THE OBSERVATORY ITSELF. THE CAMERAS WERE OPERATED FOR MORE THAN A YEAR AT THE FOUR LOCATIONS AND THEIR PICTURES SHOWED THAT TUCSON'S LIGHT OUTPUT WAS INCREASING AT THE RATE OF ABOUT TEN PERCENT A YEAR. IT WAS AN ALARMING FIGURE BECAUSE, AT THAT RATE, CONTAMINATION OF THE NIGHT SKY FROM CITY LIGHTING DOUBLES IN ONLY EIGHT YEARS.

ARMED WITH THE DATA FROM THEIR CAMERAS, THE KITT PEAK ASTRONOMERS APPROACHED THE CITY COUNCIL OF TUCSON AND PERSUADED ITS MEMBERS TO PASS AN ORDINANCE TO CONTROL OUTDOOR LIGHTING. ACCORDINGLY, NEW OUTDOOR LIGHTING IN TUCSON MUST BE DIRECTED ONLY WHERE IT IS USEFUL. AT THE SAME TIME, IT MUST BE FILTERED TO LIMIT THE COLOR OUTPUT TO THE RANGE USEFUL TO THE EYE. IN ADDITION, ADVERTISING AND RECREATIONAL LIGHTING, SUCH AS THE FLOODLIGHTS USED ON TENNIS COURTS, IS CURTAILED BETWEEN MIDNIGHT AND SUNRISE.

SINCE JUNE, 1972, WHEN THE LIGHT POLLUTION ORDINANCE WENT INTO EFFECT, THE KITT PEAK ASTRONOMERS HAVE FOUND SUBSTANTIAL CHANGES IN THE SKY BRIGHTNESS OVER TUCSON. ITS INCREASE HAS SLOWED DOWN DRAMATICALLY. AND,

VOICE: LEARNING OF THE TUCSON EXAMPLE, A NUMBER OF OTHER
(CONT) AMERICAN CITIES WITH OBSERVATORIES NEARBY HAVE PASSED
SIMILAR ORDINANCES TO SAFEGUARD THE STARLIGHT.

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(WOODPECKERS AND HEADACHES -- 3-3361 --
GORDON/L.A.)

EDITOR: BIRDS FIRST INSPIRED MAN TO FLY AND HELPED ESTABLISH
THEORIES OF AERODYNAMICS. AND THE FREE-WHEELING
CREATURES CONTINUE TO RAISE QUESTIONS AMONG SCIENTISTS.
HOW DO THEY MANAGE TO FOLLOW THEIR ANNUAL MIGRATION
ROUTES? OR HOW DO WOODPECKERS THEIR WORK WITHOUT
GETTING HEADACHES? WELL, THE LAST QUESTION HAS BEEN
FINALLY ANSWERED, AS VOA CORRESPONDENT -- AND BIRD
WATCHER -- EDWIN GORDON REPORTS FROM LOS ANGELES.

WOODPECKERS ARE A FAMILIAR SIGHT -- AND SOUND -- IN
MANY PARTS OF THE WORLD, AS THEY PECK AWAY AT THE WOOD
OF TREE TRUNKS WITH A SHARP CHISEL-LIKE BILL. THE
BIRD IS DRILLING HOLES, LOOKING FOR INSECTS FOR
NOURISHMENT, OR MAKING SPACE TO BUILD A NEST.

THE BIRDS HAVE BEEN OBSERVED DOING THEIR PECKING FIVE-
TO-SIX-HUNDRED TIMES A DAY, AND SOME OF THEM HAVE BEEN
KNOWN TO HAMMER OUT AS MANY AS FIFTEEN BLOWS A SECOND.
ANYBODY WHO HAS EVER HEARD THE RAPID RAT-A-TAT-TAT OF
A WOODPECKER CAN RECOGNIZE THE SOUND.

WHAT WE HAVE NOT KNOWN UNTIL NOW, IS HOW THE BIRD
MANAGES TO DO IT WITHOUT GETTING A SPLITTING HEADACHE.
A FEW YEARS AGO, DOCTOR PHILIP MAY, NOW A PROFESSOR

VOICE:
(CONT)

OF PSYCHIATRY AT THE UNIVERSITY OF CALIFORNIA IN LOS ANGELES, LOOKED OUT THE WINDOW AT ONE OF THE BRIGHTLY-FEATHERED HAMMERING BIRDS AND, AS HE RECALLED, "ALL OF A SUDDEN I THOUGHT, HOW WOULD I FEEL IF I WERE DOING THAT?"

DOCTOR MAY GOT TOGETHER WITH SEVERAL ASSOCIATES, A NEURO-PHYSIOLOGIST AND LABORATORY EXPERTS, AND ALONG WITH DOCTORS FROM A LOCAL HOSPITAL, BEGAN A SERIOUS STUDY. THE REASON WOODPECKERS DO NOT SUFFER CONCUSSION OR BRAIN DAMAGE, THEY FOUND, IS BECAUSE THE BIRD HAS A VERY NARROW SPACE BETWEEN THE TOUGH OUTER MEMBRANE OF THE BRAIN AND THE BRAIN ITSELF. THIS WOULD CUT DOWN THE TRANSMISSION OF SHOCK WAVES. THE WOODPECKER ALSO HAS A LARGE MUSCLE SYSTEM IN ITS HEAD WHICH COULD SERVE AS A SHOCK ABSORBER.

WELL, ALL OF THIS NEWLY ACQUIRED KNOWLEDGE ABOUT WOODPECKER IS NOT GOING TO HELP US HUMANS TO CHOP DOWN TREES OR DRILL HOLES IN WOOD. WE JUST DON'T WORK THAT WAY. BUT DOCTOR MAY STILL THINKS THERE IS A PRACTICAL APPLICATION OF THE FINDINGS. HE SAYS THEY COULD RESULT IN THE MANUFACTURE OF BETTER CRASH HELMETS OR SAFETY HATS. THOSE IN COMMON USE NOW CONSIST OF A HARD OUTER SHELL SUPPORTED BY A HARNESS FROM THE HUMAN SKULL. IF THE HARNESS WERE REPLACED WITH A FORM-FITTING SPONGY MATERIAL, THE HELMET MIGHT BE MORE EFFECTIVE IN REDUCING THE DAMAGE FROM BLOWS ON THE HEAD.

VOICE:
[CONT)

WE WILL THINK OF THAT THE NEXT TIME WE SEE ONE OF OUR
LOCAL DOWNY WOODPECKERS -- OR THE BEAUTIFUL YELLOW-
HEADED ONE -- ATTACKING A NEARBY TREE WITH THE HIGH
SPEED OF A PNEUMATIC DRILL. WE KNOW THAT THE BIRD
IS LOOKING FOR INSECTS, OR PREPARING TO BUILD A NEST.
WE ALSO KNOW ANOTHER REASON WHY THE WOODPECKER DOES IT.
IT FEELS SO-O-O-O GOOD WHEN HE STOPS.

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(COLORFUL QUARKS -- 3-3361 -- DOSA)

EDITOR: HOW SMALL IS SMALL? WHAT IS THE SMALLEST? WHAT IS THE
ABSOLUTE, IRREDUCIBLE BASIC BUILDING BLOCK OF MATTER?
THESE ARE SOME OF THE QUESTIONS THEORETICAL PHYSICISTS
ARE TRYING TO ANSWER. LASZLO DOSA HAS THE STORY.

VOICE: TWENTY-FIVE HUNDRED YEARS AGO, THE GREEK SCIENTIST
DEMOCRITUS DECLARED THAT ALL MATTER IS MADE OF TINY,
INVISIBLE BUILDING BLOCKS. HE CALLED THEM ATOMS.
IT WAS NOT UNTIL THE TWENTIETH CENTURY THAT MAN WAS
ABLE TO BREAK, OR SPLIT, THE ATOM INTO ITS CONSTITUENT
PARTS: THE RELATIVELY HEAVY NUCLEUS. SURROUNDED BY
FAST-SPINNING ELECTRONS.

FOLLOWING THE BIRTH OF NUCLEAR PHYSICS IT DID NOT TAKE
VERY LONG FOR MODERN SCIENCE TO DISCOVER THE EXISTENCE
OF SUBATOMIC PARTICLES AND NOW, PHYSICISTS ARE
WONDERING WHETHER THEY HAVE FOUND THE ABSOLUTE,
IRREDUCIBLE, INDIVISIBLE BASIC BUILDING BLOCKS OF
MATTER.

VOICE: AT THE RECENT ANNUAL MEETING OF THE AMERICAN PHYSICAL SOCIETY IN WASHINGTON, HARVARD UNIVERSITY PHYSICS PROFESSOR SHELDON GLASHOW PRESENTED THE LATEST THEORIES ABOUT THESE BUILDING BLOCKS. DOCTOR GLASHOW SAYS THAT ALL MATTER IS MADE OF TWO THINGS, CALLED QUARKS AND LEPTONS. LEPTONS ARE THE VERY LIGHT PARTICLES, SUCH AS THE ELECTRONS WHICH SPIN AROUND THE NUCLEUS OF THE ATOM. QUARKS ARE HEAVIER AND THEY MAKE UP THE ATOM'S NUCLEUS.

PROFESSOR GLASHOW CLAIMS THAT THERE ARE FOUR DIFFERENT TYPES OF QUARKS AND, FOR THE SAKE OF IDENTIFICATION, HE GIVES THEM THE NAME OF COLORS, SUCH AS RED, WHITE AND BLUE. THE FOURTH QUARK IS CALLED, FOR SOME REASON, CHARM.

NOBODY HAS EVER SEEN A QUARK, WHATEVER ITS COLOR, OR A CHARM. BUT THEORETICAL PHYSICISTS CLAIM THEY DO EXIST. KOREAN-BORN DOCTOR BENJAMIN LEE SAYS THAT WHEN ATOMIC PARTICLES ARE BOMBARDED BY HIGH ENERGY, THERE IS "SOMETHING RATTLING INSIDE" AND THAT SOMETHING MUST BE QUARKS.

DOCTOR GLASHOW MAINTAINS THERE IS NOTHING SMALLER THAN QUARKS. OTHER PHYSICISTS THOUGH, ARE NOT SO SURE. THEY QUOTE ANOTHER ANCIENT GREEK SCIENTIST, ANAXAGORAS, WHO SAID THAT MATTER WAS FORMED OF A NEVER-ENDING SEQUENCE OF SEEDS WITHIN SEEDS. IF THAT IS TRUE, THEN THE QUARK, WHICH IS THE SEED OF THE NUCLEUS, WHICH IS

VOICE: THE SEED OF THE ATOM, HAS SEEDS OF ITS OWN. PERHAPS
(CONT) THE NEXT GENERATION OF PHYSICISTS WILL FIND OUT.

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(MORE ON SOLAR POWER -- 3-3361 -- DAVENPORT/HOUSTON)

EDITOR: THE CONTINUING SEARCH FOR NEW SOURCES OF ENERGY POINTS
MORE AND MORE TOWARD THE SUN, THE OLDEST SOURCE OF ENERGY.
JOHN DAVENPORT REPORTS FROM HOUSTON, TEXAS, ON SOME NEW
DEVELOPMENTS IN THE QUEST FOR SOLAR POWER...

VOICE: THE CONCEPT OF SOLAR ENERGY IS NOT NEW. IN THE NINETEEN-
THIRTIES, A FIRM IN FLORIDA WAS INSTALLING ROOFTOP
SOLAR HEAT COLLECTORS. THE SUN KEEPS AN ATLANTA, GEORGIA,
SCHOOL WARM IN THE WINTER, COOL IN THE SUMMER. SOLAR
ENERGY CONTROLS THE TEMPERATURE IN A LABORATORY IN
SOUTHWESTERN NEW MEXICO, AND IN AN OFFICE BUILDING IN
NORTHEASTERN NEW HAMPSHIRE. BUT IN TERMS OF EVERYDAY USE,
SOLAR ENERGY IS STILL IN ITS INFANCY.

A LEADING AUTHORITY ON SOLAR ENERGY IS DOCTOR ALVIN
HILDEBRANDT, A PHYSICIST AND DIRECTOR OF THE SOLAR
ENERGY LABORATORY AT THE UNIVERSITY OF HOUSTON...

TAPE: CUT ONE -- HILDEBRANDT

"BY THE YEAR 2000, AT OUR PRESENT RATE OF ENERGY
CONSUMPTION, IT IS EXPECTED THAT WE ONLY HAVE SEVENTY-
THREE YEARS OF ENERGY AVAILABLE WITH PRESENT FOSSIL
RESOURCES. WE NEED TO DEVELOP ADDITIONAL SOURCES OF
ENERGY, EITHER SOLAR OR FUSION, OR EVEN ADDITIONAL NUCLEAR."

VOICE: DOCTOR HILDEBRANDT CAUTIONS THOSE WHO THINK SOLAR
POWER WILL SOLVE ALL OUR ENERGY PROBLEMS. IN MANY
CASES, HE SAYS, SOLAR ENERGY WILL BE USED TO SUPPLE-

VOICE: MENT OTHER FORMS OF ENERGY. THE FULL DEVELOPMENT OF
(CONT) SOLAR ENERGY TO MEET ALL THE NATION'S NEEDS BY THE END
 OF THE CENTURY WOULD REQUIRE THE CONSTRUCTION OF AN
 IMMENSE FIELD, NEARLY NINETY-THOUSAND SQUARE KILOMETERS,
 COVERED WITH SOLAR COLLECTORS. PROFESSOR HILDEBRANDT
 PROPOSES A SIMILAR APPROACH, BUT ON A MORE MODEST
 SCALE...

TAPE: CUT TWO -- HILDEBRANDT

"THE TOWER CONCEPT IS A COLLECTOR APPROACH OF
COLLECTING SOLAR ENERGY TO A CENTRAL POINT. IT
CONSISTS OF SEVERAL SQUARE KILOMETERS OF HELIOSTATS
LAID OUT ON A FIELD, THAT CONTINUOUSLY REFLECT THE
SUN ONTO A BOILER ON TOP OF A TALL TOWER NEAR THE
CENTER OF THE FIELD. THE HELIOSTATS ARE FLAT, GLASS
MIRRORS THAT REFLECT THE ENERGY CONTINUOUSLY AND ARE
THE MAIN ECONOMIC DRIVING FORCE OF THE ENTIRE CONCEPT.
WE REQUIRE FLAT HELIOSTATS, AND BECAUSE OF THE LARGE
SIZE, THIS SYSTEM CONSTITUTES A POINT FOCUS DEVICE. IT
IS VERY SIMILAR, BUT MUCH LARGER THAN THE LITTLE HAND
MAGNIFIER THAT ONE USES TO BURN LEAVES, FOR INSTANCE."

VOICE: OBVIOUSLY, AREAS WITH PLENTY OF SUNSHINE THE YEAR ROUND
 ARE THE BEST SUITABLE FOR THIS TYPE OF ENERGY COLLECTION.
 AND THE TEXAS PROFESSOR THINK' THAT SCIENCE WILL FIND
 WAYS TO STORE THE ENERGY DERIVED FROM THE SUN. ONE WAY
 OF STORING THE SOLAR ENERGY WOULD BE TO PRODUCE HYDROGEN,
 FOR EXAMPLE, WHICH COULD BE STORED AND SHIPPED WHERE
 NEEDED.

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(RADIOACTIVE WASTE BURIAL -- 3-3361 -- DOSA)

EDITOR: TO HELP STEM ANY LEAKAGE OF DANGEROUS RADIATION FROM
 RADIOACTIVE WASTE MATERIALS, THE U.S. GEOLOGICAL SURVEY
 HAS EMBARKED ON A WIDE-RANGING PROGRAM TO STUDY PRESENT

EDITOR: AND PROPOSED RADIOACTIVE WASTE DISPOSAL SITES. _____
(CONT) REPORTS.

VOICE: ONE OF THE GREATEST PROBLEMS OF NUCLEAR POWER PRODUCTION IS NOT THE QUESTION OF SAFETY. THE ATOMIC POWER INDUSTRY HAS ALL SORTS OF STRINGENT SAFEGUARDS AND A PERFECT SAFETY RECORD. THE PROBLEM IS HOW TO GET RID OF RADIOACTIVE WASTE MATERIALS -- THE UNDESIRABLE BY-PRODUCTS OF NUCLEAR POWER PRODUCTION. AT PRESENT, THEY ARE BURIED UNDERGROUND AT SEVERAL LOCATIONS IN THE UNITED STATES.

UNDERGROUND BURIAL HAD BEEN CONSIDERED SAFE UNTIL IT WAS DISCOVERED THAT, IN A FEW LOCATIONS, SOME OF THE RADIOACTIVITY HAS LEAKED INTO UNDERGROUND WATER. SCIENTISTS OF THE U.S. GEOLOGICAL SURVEY WERE CALLED UPON TO DETERMINE THE SAFETY CRITERIA AND TO HELP FIND SITES WHERE RADIOACTIVE WASTE PRODUCTS COULD BE BURIED WITHOUT FEAR OF CONTAMINATION.

WHILE THE GEOLOGISTS ARE LOOKING FOR BURIAL SITES UNDERGROUND, OCEANOGRAPHERS ARE STUDYING THE POSSIBILITY OF DEPOSITING RADIOACTIVE WASTES ON THE BOTTOM OF THE OCEAN. THEY ARE INVESTIGATING ISOLATED AREAS ON THE SEAFLOOR WHICH HAVE NOT UNDERGONE ANY GEOLOGICAL CHANGE FOR MANY MILLIONS OF YEARS. THE OCEANOGRAPHERS ARE CONFIDENT THAT THE SEAFLOOR SEDIMENT OR UNDERLYING ROCK FORMATIONS WILL PROVIDE A SAFE BURIAL GROUND FOR ALL THE RADIOACTIVE WASTES PRODUCED BY THE NUCLEAR POWER INDUSTRY.

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ANNCR: THIS HAS BEEN ... SCIENCE NOTEBOOK ... A SUMMARY OF
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